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EDUCATION AND RESEARCH[1]

By Dr. FREDERICK H. SEARES

ASSISTANT DIRECTOR OF THE MOUNT WILSON OBSERVATORY, CARNEGIE INSTITUTION OF WASHINGTON

TO-DAY'S program implies that I speak on the educational influence of the Mount Wilson Observatory. In education, a research foundation proceeds less consciously than a university. Without students in the technical sense, it has little concern with instruction. Its task is rather to procure information, which, rearranged and somewhat diluted, serves, among other ends, as a reagent for converting the uninstructed into cultivated human beings. The obligation to set forth its results is admitted; nevertheless, the chief business of a research establishment is investigation, and by its success in this undertaking its educational force finally is to be measured. Important conclusions soon become interwoven with the thought of the time; conclusions, however, must be provided.

[1] Address before the Association of Colleges and Universities of the Pacific Southwest, at the University of California at Los Angeles, April 16, 1932.

The observatory is known as a place where the sun, stars and nebulae are studied with telescopes of great power. It is less known as the Mount Wilson Observatory of the Carnegie Institution of Washington. That, however, it is—one of a group of research units maintained by the Carnegie Institution. The educational influence of the observatory is to be appraised with this organic relationship in mind.

In 1902 Mr. Carnegie placed in the hands of trustees a large sum of money, which, with later gifts, appropriations from the Carnegie Corporation and accumulated reserves, yields income for the institution. The Congressional Act of Incorporation sets forth the purpose: "to encourage in the broadest and most liberal manner investigation, research, and discovery, and the application of knowledge to the improvement of mankind."

Study of the means of providing such encourage-

ment has led to a method of operation suited to the needs of to-day: First, minor grants for special research, made to a few experienced investigators connected with other institutions, who rank as research associates of the Carnegie Institution; second, major grants to permanent divisions or departments, organized within the institution itself and directed by specialists. The Mount Wilson Observatory is one of these departments, of which at present there are ten.

A grouping of departmental names at once suggests relationships. Place together the Geophysical Laboratory, the Departments of Terrestrial Magnetism and Meridian Astrometry and the Mount Wilson Observatory. We thus begin with the earth as a physical body, studying the formation and alteration of its rocks by modern quantitative methods of physics and chemistry and the development and transfer of heat involved in mineral reactions and in changes from a liquid state to a solid. Geologic processes, hitherto treated only descriptively, are thus brought into the laboratory where they yield the exact numerical data so essential for fruitful scientific advance.

Next we study the earth's electric and magnetic conditions, with emphasis on problems of international concern. Vessels of the Department of Terrestrial Magnetism, notably the ship *Carnegie*, have cruised the waters of all the oceans from 80° latitude north to 60° south; the aggregate length of the observational trail is more than 400,000 miles. Meanwhile the land has not been neglected. Observers have visited all its parts, gathering data from nearly 6,000 stations. To obtain records of electric and magnetic changes, permanent stations are maintained in Australia and in Peru. Finally, at its laboratory in Washington, the department undertakes experimental and theoretical investigations required to interpret observations made in the field.

When we leave the earth for the stars, the first question is, Where are the stars and how do they move? The Department of Meridian Astrometry helps with the answer by providing Boss's Catalogue of the positions and proper motions of bright stars, an indispensable handbook of the astronomer. Precise observations of thousands of fainter stars, made by the department from both hemispheres and combined with earlier measures of positions, will also supply a rich store of data on stellar motions. The worth of such information shines forth when we recall that the first great advance since the time of Sir William Herschel in knowledge of the stars as a system was based on proper motions. In 1904 Kapteyn found certain regularities in the motions of stars, and from that moment the stellar system ceased to be a collection of individuals and became an organic whole.

Kapteyn's investigation of stellar motions was coincident with the foundation of the Mount Wilson Observatory, and together these events began a new epoch in astronomy. The observatory, at first an expeditionary undertaking for studying the sun under the favorable mountain conditions of this southwestern country, soon became a permanent establishment through the efforts of Hale, its first director, and the generous support of the Carnegie Institution. From his youth deeply impressed with the broader significance of evolution, Hale saw both the need and the opportunity for work on the developmental features of stars. What began as a specialized study of the sun, the nearest and most accessible of stars, thus naturally widened into investigations of the comparative history of stars as a class. Powerful telescopes were provided, and highly specialized instruments; and a physical laboratory equipped with spectrographs having the same efficiency as those used in observations on Mount Wilson turned astronomy more or less into an experimental science and increased immensely the effectiveness of the methods of research. Meanwhile Kapteyn's results on stellar motions had shown the importance of thinking of the stars as a vast structural organization.

Until recently the work of the observatory has centered around these two problems: the stars as physical units having size, mass, density, temperature and constitution, subject to a developmental process involving genesis and decay; and, second, the stars as an organic system, having structure and regularity of motion and a cosmological history of its own. To-day, however, a third fundamental problem engages our attention—the extra-galactic nebulae, gigantic systems far outside our stellar system, some of which much resemble our own system. The press has been so full of the now famous red-shift of the spectral lines of these nebulae I need scarcely add that our views of the universe will certainly be much influenced by what we learn about these remote objects.

On the biological side the Carnegie Institution has its Division of Plant Biology, its Marine Laboratory at Tortugas on one of the Florida Keys, its Departments of Genetics and Embryology, its Nutrition Laboratory in Boston. On this occasion it suits my purpose better to indicate some of the interrelations of these varied fields of investigation, rather than to tell further, even in outline, what each department does. These interrelations are important because they greatly increase the scientific effectiveness of the institution.

Every one knows the contributions that come from

highly specialized research, how little by little they increase our knowledge of the world in which we live, bring benefits to humanity, enrich our intellectual lives, and in the end subtly shape our thoughts about man's ephemeral existence in a universe whose duration eludes comprehension. It is not always recognized, however, that these results come about much faster when the specialist follows up connecting threads that lead into other fields of research. He then often finds an unsuspected interdependence which solves many riddles. Thus we learn much about plants by studying the animals that inhabit the same region. Plant distribution is a matter of soil and climate; more fundamentally it is a matter of geologic change, and only the paleobotanist, backed by the geologist as well as the physiographer, can tell why Monterey pines and redwoods grow where they do to-day. The life of the sea fluctuates with the physical-chemical conditions of its waters and is, therefore, also to be studied from the view-point of geophysics. The plant biologist splits a plant into a half dozen parts, places each in a different environment and watches the surprising results through successive generations. The stability of plant characters thus put to test is related to the work of the geneticist and the whole problem of organic evolution. Cycles in tree growth point to fluctuating rainfall, which may be related to changes in the sun. Geology is linked to geophysics, while the geophysicist tells us how to make glass for our telescopes. Terrestrial magnetism offers analogies for the magnetic field of the sun. Physicist, geologist and geophysicist combine to investigate earthquakes, and with the astronomer they study the surface features of the moon and tell us its substance.

With this degree of emphasis on interrelations, it may cause surprise to find among departments of the institution which are scientific in the technical sense a Division of Historical Research. The aim, however, is not altogether conventional history, but rather a concentration on those historical features that reflect man's development and career. Mayan archeology and the Pueblo civilizations of the Southwest fit into the program, and also the history of science. The investigator in the laboratory or at the telescope may reflect with profit to himself on the development of scientific thought; but other interconnections of man's activity with the physical world are less evident. The culture of a people, however, reflects the physiographic and climatic features of the region in which it develops. The student of trees, on the other hand, supplies a chronology for the culture and, through the intermediary of a human habitation, dates a volcanic outburst of interest to geophysics and geology. The astronomer is interested in the Mayan calendar; the archeologist, the paleontologist and the geologist find their interests converging in a cave in Nevada; and the geneticist and the botanist are provided with intellectual food as well as physical nourishment because aboriginal Americans developed from wild grasses most of our cereals.

Basic for all these things, of course, are the researches of the physicist and chemist and the powerful methods of mathematical analysis. The constitution of a star is a problem in atomic physics. The Carnegie Institution therefore aids Millikan and Noyes at the California Institute in order that they may join with the Mount Wilson Observatory in studying the constitution of matter, and supplements these efforts in its own Laboratory of Terrestrial Magnetism in Washington. It helps Michelson to repeat the famous Michelson-Morley experiment and to redetermine the velocity of light. In turn the astronomer directs the physicist to the stars as laboratories presenting conditions of pressure and temperature unattainable on the earth, under which he may test his theories of atoms.

Contacts of this kind between the Carnegie Institution and investigators connected with other institutions are represented by its group of research associates, whose roll is a list of distinction. Individually, the associates bring to the institution, besides their own contributions, fresh stimulus and wise counsel.

The gain to science from the correlation of work in different fields has proved so great that under the administration of President Merriam the organization of the Carnegie Institution has gradually been adjusted to a fuller coordination of its activities with each other and with those of other agencies. A unity of spirit and purpose has thus developed within the institution which contributes effectiveness to each of its departments.

So much for the prosecution of research. Perhaps the gist of what is pertinent here to-day might be put in a phrase, if you will permit phrase making, to the effect that a beautiful building can not be viewed through the gloom of night by casting a spotlight on the architectural detail of a doorway.

There remains, however, the vexed question of making scientific results available to that part of humanity not concerned in their accumulation. Here, of course, we come close home to the problems of scientific education. Some responsibility in this direction on the part of a research institution is recognized by all, but with the greatest diversity of opinion as to how far it extends. Part of the obligation is discharged automatically by the publication of technical results. Some investigators believe that responsibility ends when the last proof of the formal presentation

has been read; and for such the matter perhaps should end at that point. Such individuals are likely to be temperamentally unfitted to recast and summarize an investigation in a form comprehensible to a public not technically trained. Others find in the effort a self-clarification that brings new vision when they turn again to their own work. Among such are the great expositors of science, successful in instructing others, perhaps because they best succeed in instructing themselves. The dissemination of the results of research, however, is always an exacting business, demanding more than cold rationalistic approach. When most successful, the effort involves something akin to dramatic sense and a literary skill which touch the imagination without doing violence to verities or distorting perspectives, and still leave those instructed with a dominant feeling of the power of reason. He that hath the talent clearly should not hide it; nor is he likely to do so, for he will probably feel the stimulus of a responsive public. The conflicting demands of the public and the laboratory he will somehow adjust, usually, I think, to the benefit of both.

To these general reflections I may add that the Carnegie Institution recognizes its responsibility and continually seeks means by which it may present the results of its work to scientific workers and the public. Its volumes issued through the division of publications and the special publications prepared by some of its departments have prompt and wide distribution. Careful statements of its work are distributed to the press as news releases. An exhibition of its diversified activities, held annually in Washington, and series of lectures by its investigators are other means by which it approaches the public.

We at the observatory share in the responsibility. Each year we care for thousands of visitors at Mount Wilson. We give public addresses; cooperate with the Astronomical Society of the Pacific in providing annual series of popular lectures and general articles for its publications; aid with the news releases issued by the Carnegie Institution, with its yearly exhibition and its own series of lectures. We open our library to students qualified to use it, and, as occasion permits, welcome at the telescope men on fellowships of the National Research Council, the General Education Board, the Commonwealth Fund and other foundations.

Technical results printed in periodicals and books are the source for fellow workers in science and those who prepare texts for instruction; news releases, lectures and popular articles reach the general public; visits to the observatory reveal something of the atmosphere of research not conveyed by printed words. Behind all, however, and giving life to all, is the power of organized effort and the work of earnest men. Herein lies the spring that draws its waters from the heavens and from the earth and all its life. As that flows, so shall the mind of man grow and put forth new fruits and his spirit become fine.

THE STUDY OF THE MIND[1]

By Dr. WILLIAM A. WHITE

ST. ELIZABETH'S HOSPITAL, WASHINGTON, D. C.

I MUST preface the few remarks which it seems to me that an occasion of this sort warrants by expressing my deep sense of appreciation at being elected to membership in this distinguished body. Nothing could be more gratifying than the opportunity of associating myself with you through the medium of this Greek letter society. I naturally feel highly honored that my past performances have been of such a character as to lead you to ask me to join with you, and I assure you that in the future I will consider the honor of this association as a stimulus to work that will continue to command your regard.

In the few minutes at my disposal I feel that the most appropriate thing that I can do is to formulate very briefly what might be called a profession of faith, by which I mean a statement of what I conceive to be the significance of my chosen work both as it appears to me in the present and as I vision it for the future.

In the first place, no adequate understanding of the present status of the study of the human mind can be reached, as indeed might be said of any other scientific subject, without some knowledge of the historical aspects of the subject. And I may remind you in this connection that it is only very recently that the study of the human mind in its various reaches has escaped from the limitations of its associations with philosophy, theology and morals and has finally become, in my opinion, a biological science which undertakes to investigate and explain not only the outwardly observable behavior of living beings but the circumstances in that world within us, which can only be approached by methods of introspection, which are of such apparent significance in connection with our

[1] Address at the annual meeting of the District of Columbia Chapter of the Society of Sigma Xi on April 26.

behavior as to make it seem dependent on our ways of thinking and feeling.

It has been known for many years that the perception of the outer world was more or less modified by the individual, differently in different cases; and the personal equation which was developed as a corrective device for doing away with or at least minimizing the distortion that was inevitable, and which was shown in the different results obtained by different observers in recording the same phenomena, stands as a concrete expression of the realization of this fact. But such variations as one finds in this field of scientific observation, variations which showed up in the reading of scientific instruments, while it is important, is, to put it mildly, of minor significance as compared with the distortions of the universe about us which from our point of view we read into the perceptions of primitive man, of the child, and of the mentally diseased, and which as mass phenomena have invaded civilization from time to time in such expressions, for example, as the belief in witchcraft which swept over Europe, persisted for some hundreds of years, and cost hundreds of thousands if not millions of lives. All these groups of phenomena are manifestations of the distortion of reality as it filters through the individual and is interpreted by him upon the basis of his background of experience, both individually and racially.

The researches within the present century in the field of psychopathology have had as one distinct objective, among others, the correction of these distortions with a realization, quite naturally, of the philosophical implication that after all the universe is for us as we perceive it but with no longer the necessity for being controlled, inhibited and prevented from progress by such a hypothesis; for if this statement of philosophy is accepted at its face value it would mean that progress in the interpretation of the facts of reality was either impossible, or, if not that, at least outside of our control, that nothing we could do would affect the net results one way or the other. Progress voluntarily aspired to by means or methods intelligently addressed to that end would be nothing more nor less than an attempt to accomplish the impossible, but the remarkable fact is that man is able to accomplish the impossible or at least what seems to be the impossible. I might perhaps better say that life in its evolutionary and developmental progress stands out as an example of the accomplishment of the impossible, and man may continue to progress if he has the courage to discard limiting theories and go bravely forward, even though what he seeks may seem to him at the time unattainable.

The mind of man has in the present century come into its own for the first time as a worthy subject of scientific study and investigation; and if some of the investigations and some of the studies made appear to lead to rather unacceptable results, or results which do not seem to measure up to the requirements of the standards which have been attained in other scientific disciplines, it is, in my opinion, only because we are dealing with an infinitely complex group of problems and we are only beginning to attempt to deal with them in a scientific manner, free from prejudice, superstition and the like; and the important thing is not so much the accomplishment in a specific instance as the fact that sincere efforts are being made by an ever-increasing body of enthusiastic students. Even though I indicate the situation in these rather discouraging words, still enough has been accomplished to act as a sufficient stimulus for the high adventure of further discoveries, because of the tremendous importance and significance of this field as already disclosed. For example, we are beginning to feel very definitely—some of us at least—that the phenomena at what I call the psychological level of functioning of the living being, while to be sure they are intangible, imponderable and invisible, are nevertheless somehow to be related in our thinking to the manifestations of energy with which we are more familiar in the physical world. The psyche is being considered as an organ the function of which, expressed in its most generic form, is the equalizing of stresses and the releasing of tensions, with the necessary tendency to bring to pass a state of equilibrium—not a static equilibrium but a dynamic equilibrium. And as we undertake to evaluate various states of mind we can not escape from the necessity of measuring them over against the stimuli which have released them and forming some sort of judgment as to the quantitative relations between the two. We see, for example, such quantitative relations, although to be sure we have no means of measuring them with accuracy, between the depth of grief of an individual over the loss by death of a beloved friend or relative and the importance and significance of that friend or relative in the life of the survivor. We see very definite quantitative relations between the feeling of guilt and the nature of the act which has excited it; and when we realize in such instances as this latter, for example, that such a reaction is based upon an inner standard against which the individual measures his conduct, and that that inner standard is received from the cultural environment in which the individual was raised and becomes such a standard by being built into the psyche, you will perhaps understand what I mean when I say that I believe in the last analysis that the psyche may be considered as an environmental inclusion in a sense not dissimilar from that in which the blood is con-

sidered to have been originally the environmental inclusion of a droplet of sea-water, which subsequently became the circulating medium for the transportation of various substances from one part of the body to another.

If such an hypothesis, or perhaps it might better be called a speculation, should ultimately prove out, it would then mean what again we already have definite hints of: that the laws which govern in the physical world and with which we are to a certain extent familiar would be determined to govern in this apparently more tenuous and immaterial world, the world within. We would find that the relation between stimuli and mental states, as already indicated, was a quantitative one; for example, the relation between a frustration and a compensation. We would see analogies with scientific laws with which we are already familiar, and to which we would become progressively less able to remain blind.

If all the above things represent a fair statement of how we may consider mental events in their relation to other events in the cosmos, then it can be further understood how significant this particular class of events has become for an adequate understanding of the most important aspects in which we relate ourselves to our environment, namely, those inter-personal relations which have to do with our contacts with other human beings and upon the nature of which it may easily be said depends the whole future course of civilization. Civilization is a matter of the psychology of the peoples functioning at a social level of integration, and no adequate understanding of the forces that are involved can be had unless this fact is appreciated, and we can not expect to guide these forces into constructive channels unless we have this information.

While it is true that this program contemplates a procedure which looks a little as if man had the problem on his hands of raising himself by his own boot-straps, nevertheless, as I have said, this impossible performance is just precisely what he has proved himself in the past capable of doing. And so it would seem that the reception of psychology into the realm of the biological sciences, the appreciation of man from this point of view functioning as a social unit, and the attempt to fathom the intricacies of the human psyche by the development of methods of research in this field, are worthy, significant and important developments in the world of science which need to be aided, abetted and encouraged by all those who in their own particular fields may have reached a higher degree of perfection both in the observation, description and interpretation of their facts, and in the development of ways and means for their uncovering.

In any case, however, we will continue our search in the regions of the unknown and our efforts to find explanations where at present none exist; and we hope that if from time to time we make mistakes and come to conclusions that are unwarranted by the facts, that we are sufficiently loyal to the tenets of scientific methodology to be the first to welcome the criticism that will disclose our shortcomings, while in the meantime we shall, on the other hand, be able to receive contributions from other sources without exhibiting those prejudices that unfortunately too frequently mar the course of scientific progress. In this respect we trust that we may profit by our own disclosures, although we feel the burden of those human weaknesses that are common to us all; and so in attaining to recognition in the general body of the sciences we make our entrance in the hope that we may be received as one of you, earnestly working to throw light where there is now darkness.

OBITUARY

HERMAN CARL RAMSPERGER

THROUGH the death of Dr. Ramsperger on July 13 we have lost an outstanding American contributor to chemistry.

He was born in Salt Lake City, July 19, 1896, and obtained his education at the Utah Agricultural College and at the University of California, where he received the degree of doctor of philosophy in 1925. Since that time he has held positions as instructor at California, National Research Fellow at Stanford and at the California Institute of Technology, and as assistant professor of organic chemistry at the California Institute.

His main work was in the field of chemical kinetics where he made contributions of permanent importance to science. Through his work on the rate of decomposition of azomethane, we were provided for the first time with a satisfactory study of homogeneous unimolecular gas reaction whose specific rate falls off with decreasing pressure. This result was crucial in showing the effect of molecular collisions in leading to the chemical activation of molecules, and provided the experimental basis for the theoretical developments of Rice and Ramsperger, of Kassel and others which give a quantitative account of the dependence of reaction rate on pressure. The work on azomethane was followed by the determination of other unimolecular rates so that the whole field has been left in a satisfactory state.

In addition to his work in chemical kinetics, Dr.

Ramsperger had a wide acquaintance with a number of fields of physical and organic chemistry to which he made contributions. He was an investigator of great vigor, sense and insight, with interests in psychology and other sciences, and his loss is a deep personal one to many friends and colleagues.

RICHARD C. TOLMAN

PASADENA, CALIFORNIA

WILFRED WELDAY SCOTT

PROFESSOR WILFRED WELDAY SCOTT, who died on May 3 at the age of fifty-six years, received his college education at Ohio Wesleyan University, did his graduate work at that institution, at Cornell University, at Chicago University, and received his doctorate degree from the Colorado School of Mines.

After teaching for more than a decade in his chosen field in this country and abroad, he devoted the next decade of his life to practical research work in the chemical industries. With this rich background of contact with colleges, chemical laboratories and industrial plants, he returned to his major field of interest, college instruction and graduate research, as head of the department of chemistry at the University of Southern California. His was a most unusual experience—broad and varied, yet closely related. His preparation for his life work as a productive scholar and teacher of college students was both general and specialized. It involved both theory and practice; it included both philosophy and science.

College students are quick to discover evidences of productive scholarship in their teachers. They value highly instruction given by a recognized master of his field. In his laboratories, Professor Scott's students were conscious of the presence of a master mind. His understanding of the laws of chemistry and his command of the techniques of chemical analysis inspired his students to gain the knowledge and skills essential to the discovery of new processes that they too might push still farther out the frontiers of human knowledge in the field of applied chemistry.

Evidences of his mature scholarship, covering a period of more than two decades, are found on the shelves of all college libraries where are placed the products of his brain and pen;—each a comprehensive, scientific and scholarly treatment of an important field of human knowledge. The list includes:

Qualitative Chemical Analysis (1910)
Standard Methods of Chemical Analysis, 2 vols. (1917), 4th edition 1925
Technical Methods in Metallurgical Analysis (1923)
Inorganic Quantitative Chemical Analysis (1926)
Chemical Methods of Metallurgical Analysis (1927)
Elements of Qualitative Chemical Analysis (1930)
Essentials of Quantitative Chemical Analysis (1930)
A revision of one of his major works is now in the press (1932)

He was a member of the American Chemical Society, the American Association for the Advancement of Science, Phi Kappa Phi, Phi Beta Kappa, and several other scientific, scholarship, and professional organizations of national scope. Published reports of his scientific researches include the following: Fertilizers; Ferrous Sulphate Method for Determination of Nitrates; Volumetric Determination of Aluminum and Fluorine; Determination of Lead; Determination of Uranium in Carnotite; Catalyzers for Oxydation of Ammonia; Methods of Chemical and Metallurgical Analysis; Inorganic Quantitative Analysis; Qualitative Analysis.

Much as we value the memory of Professor Scott as an eminent scholar, as a nationally known scientific worker and as a master teacher, we who knew him well as a staff member and coworker on university committees value even more highly the fine human characteristics of the man. He was deeply and genuinely interested in the health and welfare of his fellow staff members. This interest was not affected, it was a natural and uncurbed expression of the great soul of the man who walked among us and worked with us. From the memories of many of his fellow workers will never be erased the recollections of his sincere expressions of deep interest in them. The society of scholars which is our university has a richer heritage because he lived, thought, wrought and taught among us.

FRANK C. TOUTON

UNIVERSITY OF SOUTHERN CALIFORNIA

RECENT DEATHS

DR. GRAHAM LUSK, who retired this year from the professorship of physiology in the Cornell University Medical College, New York City, died on July 18, at the age of sixty-six years.

DR. LOUIS WINSLOW AUSTIN, authority on physical measurements, radio transmission, and member of the staff of the Bureau of Standards, has died in Washington at the age of sixty-four years.

REGINALD AUBREY FESSENDEN, physicist and consulting engineer of the Submarine Signal Company, died in Bermuda on July 23. He was sixty-five years old.

DR. VAN HARTROG MANNING, consulting engineer, from 1915 to 1920 director of the U. S. Bureau of Mines, died on July 13, at the age of seventy years.

CHARLES WARREN HUNT, hydraulic engineer, secretary emeritus of the American Society of Civil Engineers, died on July 24 at the age of seventy-four years.

DR. HAROLD JACOBY, until his retirement in 1930 professor of astronomy and head of the department of astronomy at Columbia University, has died at the age of sixty-seven years.

CHARLES WILLISON JOHNSON, for the past nineteen years curator of insects at the Boston Museum of Natural History, died on July 19, in his sixty-ninth year.

DR. DANIEL FOLKMAR, anthropologist, until his retirement last year a special agent for the Immigration Commission and the Census Bureau, died on July 2[illegible] at the age of seventy-one years.

IT is announced that Ralph Hoffmann, ornithologist and director of the Natural History Museum, Santa Barbara, California, died by accident in July while on an exploring trip in the southwest. He was sixty-two years old.

SCIENTIFIC EVENTS

REDUCTIONS IN THE APPROPRIATIONS FOR SCIENTIFIC WORK UNDER THE FEDERAL GOVERNMENT

A SURVEY made by *Science Service* of the figures in congressional appropriation bills just published shows that during the fiscal year 1931–32 just ended, about $75,800,000 was available in the various departments for scientific and research work. For the coming year this amount has been reduced by the economy program to about $66,300,000, a cut of approximately 12.5 per cent.

Among the departments doing scientific work that suffer the most are the Geological Survey in the Department of the Interior whose funds are reduced 30.6 per cent., the National Bureau of Standards with a cut of 25.7 per cent., the Bureau of Fisheries with a cut of 32 per cent. and the Coast and Geodetic Survey with a cut of 22 per cent.

In addition to these cuts, money available for scientific research is further depleted by the special economy legislation providing for a pay reduction of 8.3 per cent. which money can not be used by the departments where the saving is made but is paid back into the treasury. During the fiscal year 1932–1933 no employee can take a vacation unless he takes it without pay. Future leave is reduced to 15 days.

Some individual programs of research are even more seriously affected than the average reduction would indicate. Cuts on specific items at the National Bureau of Standards, for example, vary from 12 and 16 per cent. on some to as much as 50 per cent. on others.

The following figures include portions of congressional appropriations for scientific and research work only. The classification in some cases is somewhat arbitrary, but the figures are comparable for the two fiscal years. In cases where the work of a bureau is largely scientific, administrative expenses are also included. Work of scientific character, though not strictly research, as for example the work of the Weather Bureau, is included in this tabulation. Scientific research done by the War Department is not included because figures are not yet available. Neither are there included funds for research that may become available under the emergency relief bill passed in the closing hours of the congressional session.

Bureau	Year 1932–3	Reduction from 1931–2	Per cent.
Geological Survey	$ 2,181,000	$ 960,740	30.6
Bureau of Mines	1,554,325	271,910	14.9
Coast and Geodetic	2,399,813	676,120	21.9
Bureau of Standards	2,137,280	737,290	25.6
Bureau of Fisheries	1,976,020	929,520	32.0
Public Health Service	5,341,413	113,369	2.08
Bureau of Labor Statistics	450,000	130,480	22.4
Children's Bureau	375,500	20,000	5.0
Women's Bureau	160,000	19,900	11.0
Smithsonian Institution	1,019,109	71,095	6.5
Aeronautics, Commerce	8,553,500	1,808,800	17.5
Navy (Hydrographic Office and Naval Observatory)	3,093,100	62,880	1.9
Forest Service	1,511,470	96,830	6.0
Bureau of Animal Industry	8,938,732	643,103	6.7
Dairy Industry	717,448	79,542	9.9
Plant Industry	4,930,874	908,364	15.5
Experiment Stations	4,668,294	88,116	1.8
Weather Bureau	4,164,038	333,682	7.4
Bureau of Entomology	2,471,700	392,040	13.7
Bureau Chemistry and Soils	1,825,080	122,121	6.2
Biological Survey	1,756,177	472,993	21.2
Agricultural Economics	4,995,491	441,845	8.1
Home Economics	233,365	13,335	5.4
Agricultural Engineering	518,690	65,150	11.1
Soil Erosion	289,160	40,840	12.3
Livestock	41,325	2,175	5.0
Total	$66,302,904	$9,502,240	

CONGRESS OF PREHISTORIC SCIENCES

FURTHER details are given in the London *Times* of the arrangements for holding in London at the beginning of August the first International Congress of Prehistoric and Protohistoric Sciences. Sir Charles Peers, president of the Society of Antiquaries and chief inspector of ancient monuments under H.M. Office of Works, is president of the congress for this session, and the formal proceedings in London will

be divided into five sections, each under British sectional presidents.

The work of the congress will deal with the whole archeology of prehistoric and early historic times, embracing the contributions thereto of geology, paleontology and anthropological studies. The origin and evolution of prehistoric man will form the subject of Section I under Sir Arthur Smith Woodward. The paleolithic and mesolithic periods will be discussed by Section II under Mr. Reginald Smith, of the British Museum. Section III will cover the neolithic, bronze and early iron ages in the ancient world, under the joint presidency of Professor H. J. Fleure, Professor J. L. Myres and Mr. Sidney Smith, of the British Museum; while Section IV will deal with the same periods outside the ancient world, under the direction of Dr. H. S. Harrison and Professor C. G. Seligman. In Section V (the transition from prehistory to history) Mr. E. T. Leeds will supervise discussions on the contacts of the Celtic and Teutonic worlds with Graeco-Roman civilization and the history and archeology of the European Dark Ages.

The opening meeting, with a presidential address on the beginnings of prehistoric studies in Britain, has been fixed for Monday, August 1, and in the evening a government reception will take place at Lancaster House, where the keeper of the London Museum, Dr. R. E. Mortimer Wheeler, will display an exhibition representative of recent work in the archeology of Great Britain. Sectional meetings for the reading of papers will normally take place at King's College, but Miss Gertrude Caton Thompson is arranging an exhibition illustrating her work on the prehistory of the Kharga Oasis for a special meeting at Bedford College.

General meetings in the evenings will be addressed by Dr. Cyril Fox, director of the National Museum of Wales; E. T. Leeds, of the Ashmolean Museum; T. D. Kendrick, of the British Museum, and Mr. O. G. S. Crawford, archeology officer of the Ordnance Survey. The work both of British excavators and of foreign scholars in this country, in the Mediterranean area, and in the East will be richly illustrated by lantern lectures, and a small illustrated handbook is to be issued as the first authoritative publication of its kind. The week's session in London is to be followed by excursions at the week-end centering on Oxford and Cambridge, and a further week in Wiltshire.

THE SIXTH INTERNATIONAL CONGRESS OF GENETICS

THE sixth International Congress of Genetics will open on Wednesday, August 24, at Cornell University, with registration of members in Willard Straight Hall in the morning and an inspection of exhibits in the afternoon. That evening the opening plenary meeting will be held, after which there will be an informal reception.

Five general invitation programs will be held on the mornings of Thursday, Friday, Saturday, Monday and Tuesday. Speakers expected for these programs are: F. A. E. Crew, Institute of Animal Genetics, Edinburgh; C. B. Davenport, Carnegie Institution of Washington, Cold Spring Harbor; R. A. Emerson, Cornell University; H. J. Muller, University of Texas; O. L. Mohr, Anatomical Institute, The University, Oslo; N. Timoféeff-Ressovsky, Kaiser Wilhelm-Institut für Hirnforschung, Berlin-Buch; L. J. Stadler, University of Missouri; M. Nawaschin, Timiriazeff Institute, Moscow; Karl Sax, Arnold Arboretum, Harvard University, Forest Hills; C. Stern, Kaiser Wilhelm-Institut für Biologie, Berlin-Dahlem; Ö. Winge, Royal Veterinary and Agricultural College, Copenhagen; A. F. Blakeslee, Carnegie Institution of Washington, Cold Spring Harbor; Harry Federley, The University, Helsingfors; G. D. Karpetchenko, Botanical Institute, Leningrad; R. Goldschmidt, Kaiser Wilhelm-Institut für Biologie, Berlin-Dahlem; N. Vaviloff, Institute for Applied Botany, Leningrad; R. A. Fisher, Rothamsted Experimental Station, Harpenden; J. B. S. Haldane, John Innes Horticultural Institution, Merton; and S. Wright, University of Chicago, Chicago. Six more technical sessions will be held simultaneously in six different fields on the afternoons of Friday, Saturday and Monday.

On Thursday evening the address of welcome and response will be given, after which Dr. T. H. Morgan, president of the congress, will give his presidential address on the subject, "The Rise of Genetics."

Friday evening, August 26, a picnic is planned for all members at Taughannock Falls. This is an unusually beautiful and interesting spot and arrangements are being made for camp fires, music, swimming, and other enjoyable features.

Demonstrations of exhibits, to which at least 350 people have contributed, will be conducted on the afternoons of Wednesday, Thursday and Tuesday. Exhibit material is promised from twenty-three countries located on six continents. Due to the efforts put into the garden exhibits and the favorable weather conditions, the live plant exhibits are in very good condition. Material for the indoor exhibits is beginning to arrive. These exhibits will be shown in the thirty-nine laboratory rooms of five adjacent buildings.

On the last day of the congress, August 31, its activities will be transferred to the New York Agricultural Experiment Station at Geneva. In the forenoon papers will be read relating to fruit and vegetable breeding. During this entire day fruit

genetics and breeding exhibits will be open for inspection and they will be demonstrated in the afternoon. Members will have the opportunity to visit the laboratories of the station, to view the collections of the living fruit and vegetable material, and to attend demonstrations of experimental work.

THE CYRUS FOGG BRACKETT PROFESSORSHIP OF PHYSICS AT PRINCETON UNIVERSITY

PROFESSOR RUDOLPH WALTER LADENBURG, of the Kaiser Wilhelm Institut für physikalische Chemie, has been appointed to the Cyrus Fogg Brackett professorship of physics at Princeton University. This is a research professorship and enables the holder to devote his full energies to furthering research in experimental physics at Princeton. He is the second incumbent and successor of Dr. K. T. Compton, who left Princeton to become president of the Massachusetts Institute of Technology. Professor Ladenburg was in Princeton last year as visiting professor.

In connection with the appointment provision has been made from the local research endowment and a special grant from the Rockefeller Foundation for the inauguration in Princeton of two new lines of fundamental research. One involves the development of high potential sources for study of the atomic nucleus. The other includes the installation of a liquid hydrogen plant for studies on the spectroscopy of the solid state.

The high potential program includes a kenetron rectification outfit for steady potentials up to 600,000 volts with which to study artificial disintegration processes along lines similar to those so successfully employed by Cockroft and Walton in the Cavendish laboratory. Work has also been started on the construction of a high potential electrostatic machine of the type developed at Princeton last year by Dr. R. J. Van de Graaff. This part of the program is the work of Dr. H. A. Barton, director of the American Institute of Physics. The machine which is being built for him employs Van de Graaff's principle but will be in an atmosphere of compressed air to reduce insulation difficulties which present themselves when such a machine is operated under ordinary atmospheric pressure.

The liquid hydrogen plant will be the fourth in America, others being at the chemistry department of the University of California, the Bureau of Standards at Washington and the University of Toronto physical laboratory. By going to these extremely low temperatures complications of the spectrum of solids present at ordinary temperatures are largely eliminated by the reduction of the heat motions of the atoms. In recent years the study of molecular spectra in gases has given a great deal of information about the nature of the chemical valence forces. Similarly the spectroscopy of the solid state will give information concerning the nature of the forces which hold crystals together. Besides this use the Princeton cryogenic laboratory will also provide the chemists under Professor H. S. Taylor with means for extending their studies of chemical kinetics and of the thermodynamic properties of matter at these low temperatures.

SCIENTIFIC NOTES AND NEWS

DR. ROSS GRANVILLE HARRISON, professor of biology at Yale University, received the degree of doctor of science from the University of Dublin on June 29.

THE University of Heidelberg has conferred an honorary doctorate on Dr. Henry Drysdale Dakin, research chemist, Scarborough-on-Hudson, New York.

AT the fifty-fifth annual commencement of the University of Oregon, the honorary degree of doctor of laws was conferred on Dr. Henry Baldwin Ward, head of the department of zoology, University of Illinois, "in recognition of his outstanding scholarship in biological sciences and his constructive work in the conservation of wild life and natural resources."

DR. THURMAN D. KITCHIN, president and dean of the department of medicine, Wake Forest College, Wake Forest, received the honorary degree of doctor of laws at the recent commencement at Duke University.

THE degree of doctor of science was conferred at the commencement of Doane College, Crete, Nebraska, on C. F. Curtis Riley, assistant professor of zoology at the University of Manitoba. Professor Riley is a graduate of Doane College in the class of 1901.

A BUST of Dr. Frederick G. Banting, Toronto, co-discoverer of insulin, will be unveiled at a summer camp for diabetic children near Cleveland on July 31. Dr. Banting will be present at the ceremony, which is sponsored by Dr. Henry J. John and the directors of the camp.

DR. ANTON J. CARLSON, chairman of the department of physiology of the Graduate School of Medicine of the division of biological sciences of the University of Chicago, has given the initial contribution toward a fund of $30,000 to provide a fellowship in honor of Dr. Arno Benedict Luckhardt, professor of physiology in the school. It is planned that the fellowship is not to be awarded until the fund reaches

$30,000 or more so that the annual amount of the fellowship will be at least $1,500.

Nature reports that the following have been elected foreign members of the Geological Society of London: Professor R. A. Daly, Sturgis-Hooper professor of geology in the Museum of Comparative Zoology at Harvard University, authority on igneous rocks and mountain building and on coral reefs; Professor Paul Niggli, University of Zurich, distinguished for his work on ore deposits and crystallography, and Professor Bailey Willis, Stanford University, known for his work on geological structures. Foreign correspondents have been elected as follows: Professor C. P. Berkey, Columbia University, New York City, secretary of the Geological Society of America, who has carried out geological studies in Mongolia and elsewhere; Professor H. A. Brouwer, University of Amsterdam, known for his work on the geology and petrology of the Dutch East Indies; Professor Hans Cloos, University of Bonn, an authority on the tectonics of igneous intrusions; Professor W. K. Gregory, curator in the American Museum of Natural History, New York City, distinguished for his studies on fossil vertebrates, and Dr. Victor Van Straelen, director of the Natural History Museum in Brussels, distinguished for his work on fossil Crustacea.

WE learn from *Nature* that the Keith Prize of the Royal Society of Edinburgh has been awarded by the council to Dr. A. W. Greenwood, lecturer in the Institute of Animal Genetics, University of Edinburgh, for papers on the biology of the fowl, and the Neill Prize to Dr. C. H. O'Donoghue, reader in zoology in the University of Edinburgh, for papers on the blood vascular system, and for earlier work on the morphology of the *corpus luteum*.

THE British Institute of Physics announces that the British Instrument Manufacturers Association prize for the best paper published in the *Journal of Scientific Instruments* during the year 1931 is to be equally divided between Mr. H. C. H. Townend, of the National Physical Laboratory, for his paper on "A Daylight Factor Integrator," and Professor E. W. Marchant, Mr. J. K. Burkitt and Mr. A. H. Langley, of the University of Liverpool, the joint authors of the paper, "A Portable String Galvanometer for Use at Moderate Frequencies," and the Institute of Physics prize for the best contribution to the Laboratory and Workshop Notes in the *Journal* has been awarded to Mr. F. W. Kirkby, of the Royal Aircraft Establishment, Farnborough, for his note, "Improved Method of Holding Mirrors for Sextants and Other Instruments."

THE first Colyer prize, founded by the Royal Society of Medicine in 1926 to commemorate the twenty-five years' service of Sir Frank Colyer as honorary curator of the Odontological Museum, has been awarded by the council of the society to Mr. Martin A. Rushton, for his work on "matters regarding dental science during the past four years." Mrs. Lilian Lindsay has been appointed to the lectureship on the history of dentistry, founded in 1927 in memory of Mr. C. E. Wallis by his brother.

DR. P. E. BROWN has been made head of the department of farm crops and soils at the Iowa State College, where he has been for the past twenty-two years professor of soils. He is also head of the Farm Crops and Soils Section of the Agricultural Experiment Station and director of the Iowa Soil Survey. Dr. Brown has been acting head of the department since last fall, when Professor W. H. Stevenson resigned, owing to ill health.

PROFESSOR THORNDIKE SAVILLE, professor of hydraulic and sanitary engineering at the University of North Carolina, has been appointed to a similar position at the College of Engineering of New York University.

DR. F. C. ELLIOTT, of Kansas City, has been appointed dean of the Texas Dental College at Houston.

DR. P. W. WHITING, of the department of zoology at the University of Pittsburgh, has been promoted to a full professorship.

DR. S. J. BECK, senior resident psychologist at the Boston Psychopathic Hospital, has been appointed for the coming year research assistant in psychology in the department of psychiatry at the Harvard Medical School.

DR. L. J. WILLS has been appointed professor of geology at the University of Birmingham to succeed Professor W. S. Boulton, who retires at the end of the current session.

M. BEGHIN, of the Sorbonne, University of Paris, has been appointed professor of physical and experimental mechanics to succeed M. Koenigs.

DR. CHARLES W. EDMUNDS, professor of materia medica and therapeutics in the University of Michigan, has been elected vice-chairman of the medical section of the National Research Council and a member of the executive committee.

DR. MADGE THURLOW MACKLIN, of the University of Western Ontario Medical School, London, recently addressed the staff of the Cancer Research Laboratories, University of Pennsylvania Graduate School of Medicine, on "The Rôle of Inheritance in Human Neoplasms and its Diagnostic Significance."

DR. S. W. RANSON, Northwestern University Medical School, has received a grant from the Committee

on Scientific Research of the American Medical Association to be used in a study of the structure and function of the spinal nerves in man.

DR. R. E. COKER, professor of zoology at the University of North Carolina, has leave of absence for a year on the Kenan Foundation for Biological Study in Germany.

DR. R. G. AITKEN, director of the Lick Observatory, University of California, has taken up his work after an absence of three and a half months during which he received the gold medal of the Royal Astronomical Society of England and delivered the annual Darwin lecture before that organization. During his stay in London he gave a lecture before the British Astronomical Association.

DR. WALTER CARTER, professor of entomology in the Graduate School of Tropical Agriculture and entomologist at the research station of the Association of Hawaiian Pineapple Canners, is a delegate to the International Congress of Entomology in Paris. From there he will go to Jamaica and Central America in a search for parasites of the pineapple mealy bug.

DR. RICHARD P. STRONG and Dr. A. W. Sellards, of the department of tropical medicine of the Harvard University Medical School, were invited guests for the centenary meeting of the British Medical Association, held in London from July 26 to 29.

THE American Mathematical Society has appointed the following delegates to the International Congress of Mathematicians to be held in Zurich, Switzerland, September 4–12, 1932: Professor Edward Kasner, Columbia University; Professor C. N. Moore, University of Cincinnati; Professor R. G. D. Richardson, Brown University; Professor E. B. Stouffer, University of Kansas, and Professor J. D. Tamarkin, Brown University.

THE sixty-first annual meeting of the American Public Health Association will be held in Washington, D. C., from October 24 to 27, with headquarters at the Willard Hotel. The Association of School Physicians will hold its meetings on the Friday, Saturday and Sunday prior to October 24; this association will also meet in joint session with the Child Hygiene and Public Health Nursing sections for one or more programs. The State Sanitary Engineers will meet on Friday, Saturday and Monday for their own conferences and will then join with the Public Health Engineering Section of the association. The Public Health Education Section will conduct an institute, arranged for Saturday and Sunday, October 22 and 23, at which short and intensive courses in the philosophy and principles of health education will be given and practical suggestions offered for organizing health education programs. The Industrial Hygiene Section is planning a special exhibit, indicating the special hazards, problems and general progress in preventive medicine in industry. At the scientific sessions one program will be devoted to mental hygiene. The Committee on Training and Personnel will sponsor a luncheon at which the training of engineers, nurses and health officers will be discussed. Diphtheria will be discussed at another luncheon. There will be symposiums on air hygiene; incidence, identification and significance of bacterial carriers: standard methods; bacterial dissociation; vital statistics; registration problems, and the participation of the medical profession in public health work. In addition specially planned sight-seeing tours and trips to places of scientific interest have been arranged.

THERE will be a meeting of the New York State Section of the Society of American Foresters on September 1 and 2 at Warrensburg, New York, at the Pack Demonstration Forest. The program will begin with a dinner at the Adirondack Hotel in Warrensburg. The following day will be spent in the forest, three miles north of Warrensburg on the Albany-Montreal highway. The economic situation as it relates to the employment of foresters will be taken up at the meeting.

AN invitation has been extended by the provincial governments of Ontario and Quebec through the Society of Economic Geologists to seventy-five of the leading geologists in North America to meet on July 31 at North Bay, Ontario, from which they will travel by special train and river boat to the principal gold-producing areas. The object of the expedition is a first-hand study of the underground formations in the Kirkland Lake, Porcupine and Rouyn districts. After a week in the gold fields, during which the workings of the Kirkland Lake, Noranda, Hollinger, McIntyre, Dome and Siscoe mines will be inspected, the party will return to Toronto and Montreal. John Dresser, of Montreal, regional vice-president of the Society of Economic Geologists, is in charge of the arrangements for the expedition.

ACCORDING to a dispatch to *The New York Times*, the Canadian Pacific steamer *Montcalm* sailed on July 20 for Canada carrying a number of British astronomers, who expect to observe the eclipse of the sun from Canada and New England on August 31. Dr. John Jackson, the chief assistant to Sir Frank Dyson, the astronomer royal, heads the party from Greenwich Observatory. To photograph the sun's corona he is taking a large telescope used in England during the eclipse in 1927. The Greenwich party is going as far north in the wilds of Quebec as it dares

take its heavy equipment. Professor Frederick Stratton, of the Cambridge Solar Physics Laboratory, is leading a party to Magog, near the Vermont boundary, while Dr. Herbert Dingle, of the Imperial College of Science, will observe the eclipse from Montreal. Later the delegates, with other European visitors, will attend the meeting of the International Astronomical Union at Harvard University.

A SECOND expedition left England on July 9, in connection with the International Polar Year—1932–33. This expedition, which is being sent out by the Radio Research Board, is to make special wireless observations at Tromsö, within the Arctic Circle. The party, consisting of Professor E. V. Appleton, Mr. G. Builder, Mr. R. Naismith and Mr. W. C. Brown, sailed in the motor-vessel *Venus* from Newcastle for Bergen, whence they proceeded to Tromsö.

HANS KNUDSON, of the Danish Observatory at Copenhagen, arrived at Rio de Janeiro on July 5 on the way to the island of Tristan da Cunha to install a magnetic observatory. The small colony on Tristan da Cunha has been described as the loneliest in the world. About 130 persons, descendants of Napoleon's guards at St. Helena, live on the extinct volcano which towers 8,000 feet up out of water two miles deep. It is about half way between Africa and South America.

PLANS for extensive educational and scientific exhibits in the buildings of Rockefeller Center, New York City, were outlined by the Rockefeller interests after an announcement in Washington that President Hoover had signed a bill authorizing the entry under bond of foreign goods for such purposes without prepayment of customs duty. The legislation is intended to foster displays of the arts, sciences and industries of many nations, "together with products of the soil, mine and sea." Duties will be paid on any such goods sold while on exhibition. Articles remaining on display for more than two years will be subject to customs charges.

DISCUSSION

THE MUDDY MOUNTAIN THRUST IN FACT AND IN FICTION

I HAVE had my attention called to two articles in which some reference is made to my work in the Muddy Mountains of southern Nevada. These articles are published in *The Pan-American Geologist*, and the author is the editor of that journal, Charles Keyes. Neither of the papers is complimentary to me, and in one of them the author's denunciation of my poor efforts can only be described as vituperative. This condemnation I accept humbly, bearing in mind that the human spirit grows arrogant on a diet of praise. My wonder is aroused, however, by a peculiar statement that is made in the first paper and somewhat amplified in the second.

In the October number of his journal, 1929, Keyes published an article entitled "Reflection of Submontane Structures in Desert Range Features." On pages 204–205 of that issue he represents that an examination of borax mines in White Basin led him to the discovery, a full decade before I was in that country, that the Muddy Mountains are underlain by a great thrust fault. In the April issue of his journal, 1932, is an article by Keyes entitled "Mechanics of Orogenic Over-thrusting." On pages 205 and 206 he states that he discovered the thrust "a decade or so" before I saw it, and that he so directed the building of the borax road from the railway point to White Basin that the grade exposed a clean section of the thrust.

The Muddy Mountain thrust is so beautifully exposed that every geologist whom I have guided to the area has exclaimed that the structure is "diagrammatic." This truly remarkable geologic exhibit requires no artificial cuts for its demonstration; it is exposed so plainly and on a scale so large that any competent student of tectonics would recognize it after a brief examination of the area. If any geologist should state simply that he was in the Muddy Mountains and saw the thrust before I described it, I would believe him readily. But Keyes does not make any such simple statement; he amplifies his claim by tying it to events that are dated exactly. It is this fact that excites my profound wonder and leads me to lay the facts before my colleagues in geology.

My study of the Muddy Mountains was made in the summer and fall of 1919. During part of that time I was assisted by a worthy Mormon prospector, John Perkins. On our pack-train expeditions together Perkins used every opportunity to ply his trade, and after I left the region he continued to prospect actively. Exactly one year later—in the late fall of 1920—Perkins discovered small deposits of colemanite in the Tertiary beds of White Basin. His discovery was epochal. Not only were these the first borate deposits ever reported from Nevada, but, as Hoyt S. Gale wrote,[1] "These discoveries are also notable in that they constitute the first record of commercial deposits of the mineral colemanite outside the State of California, not only in the United States but

[1] "The Callville Wash Colemanite Deposit," *Eng. and Min. Jour.*, Vol. 112, p. 524, 1921.

apparently in the whole world."[2] Announcement of the find was followed at once by a rush of prospecting, resulting in the discovery of other workable beds of colemanite, including the large Callville Wash deposit south of the Muddy Mountains. In 1921 the Pacific Coast Borax Company constructed the automobile road connecting the White Basin deposits with a point on the Union Pacific Railway. This road was laid out through rugged topography along the route of an old Indian trail, and crosses the large window in which the thrust is so well exposed.

The foregoing recitation of facts and dates leads to the following summary: When I studied the Muddy Mountains in 1919 there was not so much as a prospect pit in White Basin, and the site of the present borax road was marked only by a rough and obscure trail. Therefore in the first of the articles mentioned above, Keyes claims to have inspected mine workings more than ten years before the first of those workings was begun or even conceived; in the second quotation he practically repeats and elaborates this remarkable claim. That he wrote his statements with full knowledge of the date of my field work is indicated by his references to my publications on the Muddy Mountains, including my original paper, which appeared in January, 1921.

I refrain from stating obvious conclusions, and also from commenting at length on the general merits of the two papers by Keyes. One additional fact is somewhat illuminating. In the more recent article Keyes gives the appearance of supporting his claims regarding the Muddy Mountain thrust by printing footnote references (without titles) to several of his own earlier publications. Some of these (supposed) articles can not be found in the places cited (perhaps because of grievous errors in the printing of the citations), and the others make no mention of a thrust in the Muddy Mountains but discuss the efficacy of wind as a geologic agent.

Before this article was submitted for publication, the writer wrote to Keyes, pointing out that some of his printed statements appear to be contrary to fact and asking him for an explanation. His reply contains additional grave discrepancies and does not explain any of those discussed above.

YALE UNIVERSITY CHESTER R. LONGWELL

THE SPONTANEOUS OXIDATION OF CYSTEINE

IN a note recently published,[1] Elvehjem criticizes my conclusion[2, 3] that cysteine is autoxidizable, stating that the oxidation observed can not be called autoxidation until the possible presence of metals other than iron and especially copper and manganese has been considered. He states also that, since copper is a catalyst at least sixteen times stronger in cysteine oxidation than is iron, the oxidation could be explained by the presence of traces of copper.

The possibility of traces of contaminants other than iron has been considered and tests, carried out both at the time the reported studies were made and since their publication, have proved as conclusively as a negative can be proved the absence of the metals mentioned. Some of the cysteine used in the experiments had been recrystallized by the method described by the author[4] as often as sixteen times. The rate of oxidation of cysteine thus prepared was identical with that recrystallized but six times, indicating that the additional crystallization did not affect the purity of the product with respect to possible contaminating metals which may act as active catalysts. Further, the samples of the cysteine thus prepared were ignited in two-gram samples and tested for both iron and copper. In no instance was there a visible residue nor any evidence of the presence of either of these metals. The method employed for testing for traces of copper was that described by Yoe,[5] which makes use of the purplish brown color produced when a solution containing copper ions is added to potassium ferrocyanide. This method is sensitive to 1 part in 2,500,000.

Further evidence of the absence of copper was manifest in the failure of cyanide to reduce the oxidation rate of the purified cysteine. Since cyanide is such a powerful poison to both iron and copper catalysis, and since its addition failed to affect the rate of oxidation, it was concluded that both iron and copper were absent.

That manganese, too, was absent was shown by the results of preliminary tests not included in the papers published. The oxidation of cysteine was carried out in the presence of 0.2 molar pyrophosphate which, as Warburg has shown,[6] completely inhibits the activity of iron and manganese but not of copper. The oxidation rate was neither increased nor decreased, the average of several runs being very nearly that obtained for a series of runs on cysteine alone.

In view of the considerations outlined above, it must be inferred that Elvehjem's criticisms are unwarranted and that the oxidation rate observed represents approximately the basic rate of oxidation

[2] Another account of the deposits and their discovery was published by L. F. Noble in "Colemanite in Clark County, Nevada," U. S. Geol. Surv. Bull. 735-B, 1932.

[1] C. A. Elvehjem, SCIENCE, 74: 568–9, 1932.

[2] E. G. Gerwe, *J. Biol. Chem.*, 92: 399–411, 1931.

[3] E. G. Gerwe, *J. Biol. Chem.*, 92: 525–33, 1931.

[4] E. G. Gerwe, *J. Biol. Chem.*, 91: 57, 1931.

[5] J. H. Yoe, "Photometric Chemical Analysis," New York, 1: 182, 1928.

[6] O. Warburg, *Biochem. Z.*, 187: 255, 1927.

which pure cysteine undergoes. The fact that small amounts of iron or copper salts accelerate the oxidation of cysteine by air does not at all prove that a slow oxidation can not take place in their absence. Nor is there reason to suppose that copper and iron and possibly manganese are the only elements having the power of combining spontaneously with oxygen when in a pure state; but on the contrary the evidence is that carbon, sulfur, silicon and a great number of other elements have these same powers. The fact, if it be such, that pyrophosphate fails to check cysteine oxidation and also fails to prevent the catalytic action of copper on the oxidation does not at all prove that therefore the oxidation of cysteine is due to traces of copper. Such a conclusion is a *non-sequitur*. All that it shows is that pyrophosphate is inert in effecting the oxidation, whether catalyzed by copper or not.

ELMER G. GERWE

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THE IRON-DEFICIENCY HYPOTHESIS IN PELLAGRA

IT is not desired to further the controversy between Bliss[1] and Halliday[2] regarding the soundness of the hypothesis presented by Bliss that pellagra is an iron-deficiency disease, nor to enter into a discussion of the nature of the specific food factor concerned in pellagra. However, since Bliss' position is largely based upon an erroneous interpretation of the more recent literature, a correct presentation of the facts may, at least, serve to forestall misplaced confidence in iron therapy in the treatment of pellagra.

In presenting his hypothesis, Bliss[3] fails to make available sufficient working details of his own observations, depending upon his appraisal of the literature, chiefly the work of Goldberger and his associates, for its support. The following is presented as the keynote of his argument:

> "Goldberger and his associates adopted the working hypothesis that blacktongue of dogs is the analogue of pellagra in man, and they found that diets which are effective in preventing pellagra in man are also effective in preventing blacktongue of dogs—and the same is said of the curative effects of those diets. Examination of the protocols published by Goldberger reveals the fact that those diets which prevented or cured blacktongue in dogs are just those to which had been added 'syrup iodid of iron U.S.P.,' and those diets which when fed to dogs produced blacktongue or failed to cure the disease are those to which no iron had been added. Apparently the iron was not added to or withheld from those diets with any intent to affect the balance of the element, because the footnote explains that it was added to 'improve the mineral composition of the diet.' They make no further mention of iron."

The least that can be said of the above is that it is erroneous and misleading, and may be dismissed once and for all by the statement that at no time was syrup iodid of iron used by Goldberger and his associates in their studies in dogs, and no mention is made of it in any of their reports on blacktongue. It is, however, fair to state that the experimental basal diet used in the human studies at Milledgeville, Georgia, contained this substance, but it was a constant basic factor in all diets used, regardless of whether pellagra was or was not prevented.

Bliss also cites the fact that while beef, liver and yeast have been found to rate high as blacktongue and pellagra preventives, they are also rich in iron. However, he makes the mistake of including egg yolk in this group. Although very rich in iron, this substance made such a poor showing as a blacktongue preventive[4] that its test in human pellagra was not considered worth while. Milk[5] and tomato juice,[6] which, though poor in iron, were found to be pellagra preventive, are left out of consideration; and wheat and cowpeas,[7] which, like egg yolk, are high in iron but low in the pellagra preventive factor, are not mentioned. He also overlooked the fact that while yeast itself was found to be a rich source of this protective factor, its dried watery extract[8] was even better, and its charred form,[9] which retains all the iron, was entirely devoid of it. It would therefore seem that in formulating his iron deficiency theory, Dr. Bliss either overlooked the nullifying nature of the very facts by which he attempts to support it or failed to grasp their significance.

G. A. WHEELER

U. S. PUBLIC HEALTH SERVICE,
WASHINGTON, D. C.
MARCH 7, 1932

[1] S. Bliss, "The Iron-Deficiency Hypothesis in Pellagra," SCIENCE, 75: 266, March 4, 1932.

[2] N. Halliday, "The Lack of Correlation between Anemia and the Pellagra-like Symptoms in Rats," SCIENCE, 74: 312, September 25, 1931.

[3] S. Bliss, "Considerations Leading to the View that Pellagra is an Iron-Deficiency Disease," SCIENCE, 72: 577, December 5, 1930.

[4] Goldberger and others, U. S. Pub. Health Rep., Vol. 43, No. 23, Wash., D. C., June 8, 1928 (Reprint 1231).

[5] Goldberger and others, U. S. Pub. Health Rep., Vol. 39, No. 3, Wash., D. C., January 18, 1924 (Reprint 895).

[6] Goldberger and others, U. S. Pub. Health Rep., Vol. 42, No. 19, Wash., D. C., May 13, 1927 (Reprint 1157).

[7] Goldberger and others, U. S. Pub. Health Rep., Vol. 43, No. 23, Wash., D. C., June 8, 1928 (Reprint 1231).

[8] Goldberger and others, U. S. Pub. Health Rep., Vol. 41, No. 8, Wash., D. C., February 19, 1926 (Reprint 1062).

[9] Goldberger and others, U. S. Pub. Health Rep., Vol. 43, No. 12, Wash., D. C., March 23, 1928 (Reprint 1216).

QUOTATIONS

SCIENTIFIC LEADERSHIP IN INDUSTRY

IT is difficult to assess the responsibility of the absence of scientific leadership for many of the grave problems confronting society. Under the conditions of modern civilization, the community in general and not industry alone is dependent upon pure and applied science for its continued progress and prosperity. Under the influence of modern scientific discoveries and their applications in many directions other than industry, the whole basis of society is rapidly becoming scientific, and to an increasing extent the problems which confront the national administrator, whether judiciary or executive, involve factors which require scientific knowledge for their solution.

The Industrial Parliament visualized by Capt. Harold Macmillan, M. P., is an indication of the extent to which the changed conditions of the modern State are bringing us to consider the desirability of reorientating representation on the basis of functional groups in order to link up knowledge and power more effectively in the service of the state and the general interest. Few aspects of civil life, for example, illustrate more aptly the hiatus between knowledge and action than the field of transport. Whether we consider road transport, the railways, shipping, or aviation, the facilities which exist to-day are the outcome of scientific discoveries and their application, and the problems they present to society are in the main due to the absence of scientific organization and control, and consequent development along haphazard lines ruinously expensive to the community as a whole.

In spite of the warning given by the recent Royal Commission on Transport about the absence of vision in such matters and its demonstration of the way in which ignorance and prejudice can bind burdens on the backs of posterity, as with railway development last century, neither in respect of the electrification of suburban services nor in the diversion of heavy goods traffic from the road to rail have any adequate steps been taken to give effect to the recommendations of the Commission, although both these recommendations should encourage employment and the recovery of the railways from their difficult position. In the absence of a more scientific policy, it is still common for a heavy goods lorry to do damage to a road in a few hours amounting to several times the combined value of the lorry and its load.

In other fields we have a number of problems created by industrial wastes. River pollution is becoming increasingly serious as fresh areas of the country are industrialized or the scale of industry increases. The beet sugar industry and the dairying industry provide two recent examples and also illustrate the assistance which scientific research can give in preventing or minimizing the nuisance.

Again, the introduction of oil fuel for steamships immediately created a problem of waste-fuel disposal, and the layman could not have been expected to predict the serious consequences to marine and bird life and to many of our coastal resorts of a policy of dumping waste oil at sea. As in problems of atmospheric pollution, the solution lies almost entirely in the application of scientific methods of prevention and control, and in securing support for a scientific policy designed for the general advantage.

These and numerous similar problems have arisen through society using the results of scientific discoveries unguided by scientific and unprejudiced investigation of their reactions on the life of the community. Many such problems need not have become acute had an elementary amount of such foresight and scientific investigation been exercised in the early stages of the development of scientific discoveries, before the creation of vested interests or the growth of those local prejudices which generally hinder so strongly the development of a rational plan.

There are other wide fields in which the contribution of the scientific worker to the welfare of society is equally important and essential. Notably this is true in regard to food supply, where science is responsible not merely for protecting society against adulteration and for securing the purity of all kinds of foodstuffs, but also for the introduction of fertilizers giving higher yields per acre, for breeding new varieties which enable the zone of profitable cultivation to be extended, and for improved agricultural machinery and methods of cultivating and draining the soil. In addition, scientific research is urgently needed not only in the development and application of new insecticides and fungicides for the prevention or control of diseases or pests in the field, but also to an increasing extent to protect the harvested crops from damage by insect life, fungi, or moulds during storage. The colossal losses caused by insects and moulds to such products as cocoa, tobacco, dried fruit, grain, etc., in storage are as yet largely unappreciated by the public in Great Britain, in spite of the importance of storage space to a country which is so largely dependent upon imported foodstuffs.

In another but related direction, scientific workers are conducting investigations into the changes which occur in fresh fruit, meat, and fish in low-temperature

storage and transport which have already assisted in improving the market condition of fruit, in minimizing wastage during long voyages from overseas, and in improving the handling and transport of white fish so that a larger proportion of the catch can now be landed and marketed fresh than was formerly possible in half the time. The importance of such work in establishing on a firm basis the struggling fishing industry of Great Britain is obvious, apart from its national and social aspect.

Investigations of this type, closely related as they are to the welfare of society, are frequently long-range investigations requiring close cooperation between a number of classes of scientific workers. Only administration capable of taking a long-range and scientific point of view is competent to secure the necessary continuity or coordination, and in few fields is definite planning more important. Problems of food production and preservation should be taken out of the arena of political prejudices and debate into an atmosphere of impartial scientific examination.—*Nature.*

SCIENTIFIC BOOKS

New General Catalogue of Double Stars within 120° of the North Pole. By ROBERT GRANT AITKEN. Two volumes, pages i–lxviii, 1–1488. Carnegie Institution of Washington, 1932.

RARELY has any astronomical publication been so eagerly awaited by a considerable group of scientists as Aitken's new catalogue of double stars, and even more rarely has its appearance so justified every expectation. To say that its value is immense to every active observer or person interested in the theory of the subject is to put the truth mildly.

To those privileged to know R. G. Aitken personally, the ample and generous acknowledgment of the part taken in the inception of the work by the late Eric Doolittle comes as no surprise. As a model of paying tribute to a late colleague it can not be surpassed. In honoring the dead so fully, the author has honored himself.

He tells how Burnham, the author of the great B. G. C., in his last years turned over his data to Doolittle, who in turn tried to carry on the task, always overworking himself and later in failing health. Doolittle in turn made Aitken promise to carry the work to completion, should he have to give it up. His untimely death in 1920 brought this labor to Aitken sooner than the latter ever thought it could be, as Doolittle was not an elderly man at his death.

The work of bringing Doolittle's data up to date and keeping them so, and the untold labor of planning, arranging and preparing the great catalogue and carrying its publication to completion were all borne by Aitken, with able clerical assistance only.

The catalogue itself contains 17,180 doubles. Every double star north of declination –30° discovered and announced up to 1927 is included therein. It is true that most of the old faint Herschel and other similar "doubles" of 10″ and over, which cumbered the B. G. C. to the great handicap of its usefulness, are omitted. But as such "doubles" no longer come within the meaning of the term or have reasonable chance of physical connection, this omission is a vast improvement. Without repeating most of the observations listed in the B. G. C., the discovery measure and one other are usually given. Some measures made before 1905 which were not available to Burnham and all the measures since made up to 1927 then follow in order. The new catalogue becomes therefore both a supplement to and a new and improved edition of the B. G. C.

In the modern observations given as yearly means for single observers, or, in cases of many observers in one year, as combined weighted yearly means, every double star observer can see how his work compares with that of others. Needless to say, this information, never before available in such generous quantity to astronomers of this generation, should be of real value to every one and make the determination of constant differences at last a possibility. Having everything necessary for one star on one page, instead of having to consult two volumes, is also a great convenience. A really useful observing list can now be prepared without weeks of hard labor, as it is easy to see what stars stand in need of more measures. Useless duplication can easily be avoided.

The reviewer has not actually used the tabular matter as yet, so has had little chance to find typographical errors, if such exist. The only thing that has occurred to him as a possible improvement is the insertion of some appropriate letter or symbol to indicate those observations made by photography. While the reviewer is one of the persistent advocates of the accuracy of photographic measures of doubles when they are made on plates taken with refractors of long focus, he has little faith in those made with the astrographic telescopes or others of short focal length, if the doubles are under 5″. As measures on such plates occur in considerable numbers, and also as some observers have published both visual and photographic results, it would have been a help to

be able to differentiate one class from the other without consulting the original sources.

The catalogue is a work which deserves the highest praise. It is compiled by the foremost double star observer of all time, and will be invaluable to every one interested in this branch of astronomy for the indefinite future. The printing is clear and the size of the type good. The two volumes in which it is contained are of equal size and will be most convenient to handle. The Carnegie Institution is to be congratulated on their wisdom in assuming the financial burden of its publication.

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Life-Histories of the Frogs of Okefinokee Swamp, Georgia. North American Salientia (Anura) No. 2. BY ALBERT HAZEN WRIGHT. The Macmillan Company, New York. xv–497 pp., 45 plates, $8.00. 1931.

DR. WRIGHT, in his well-known first book (1914) on the North American frogs, gave us detailed life histories of the eight forms common at Ithaca, N. Y. In this second and larger work, he adds the life histories of sixteen Southeastern species and one Northern one. The headings for each species indicate the scope of the treatment: scientific name, common name, range, general appearance, measurements, habitat, first appearance, general habits, voice, mating, ovulation, eggs, hatching period, mature tadpole, larval period, transformation growth, food, autumnal disappearance, affinities, bibliography.

The treatment, for the species studied, is all that can be desired. In especial, commendation is due for the method of quoting all the previous statements about each form, so that this book contains all the scattered information (sometimes somewhat contradictory) about each form. Naturally, more recent observations have more weight, yet it is not necessary to go beyond the pages of Dr. Wright's book to see what the older naturalists said, since he has included their remarks. To some this may seem a defect, as early observations are given the same apparent weight as later ones, yet to the reviewer it seems the only proper way of reporting habits.

Dr. Wright has laid himself open to criticism from certain quarters on account of his extreme conservatism in regard to matters strictly taxonomic. He undoubtedly knows more about these frogs than any one else. Why, then, has he not made more definite pronunciamentos as to affinities, synonyms, etc.? The reviewer thinks that the answer is clear, and also thinks Dr. Wright should be complimented rather than blamed for this apparent omission. The title of the work is "Life-Histories." Dr. Wright has chosen to do life-history work, and he has done it extraordinarily well. To criticize his work because he did not do a quite different piece of work, is, to the reviewer's mind, uncalled for and unjust. There are more good systematists in this country than there are good workers on life histories, and while the present work is not a systematic treatise, it doesn't pretend to be, and that is one of its chief virtues.

The title is slightly misleading. While most of the species are from the Okefinokee, *Rana sphenocephala* is not, yet no one will quarrel with its inclusion. *Hyla versicolor* and *Rana clamitans* were treated in his work on Ithacan species, yet they are definite Okefinokee forms.

The life-histories of *Pseudacris nigrita, P. ornata* and *P. occidentalis* are really not given with anything like the completeness of the other species included. Since his Ithacan paper only briefly touched on a northern Pseudacris, there is a big gap in eastern frog life-histories to be filled, the only well-known one being *P. ocularis,* which Dr. Wright has treated exhaustively in this paper.

Pseudacris aside, there remain from the eastern region the following frogs whose life-histories are relatively unknown, or at least not described with the wealth of detail and the accuracy given by Dr. Wright: *Scaphiopus holbrookii albus, Bufo fowleri, Eleutherodactylus ricordii, Hyla cinerea evittata, Hyla avivoca* and *Acris crepitans.* These with the various Pseudacris are mostly rare, local or problematical forms.

One hopes that Dr. Wright will eventually deal with these with the same care and skill with which he and he alone (save for *Hyla andersonii*) has made us acquainted with the life-histories of the other eastern forms.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A DEVICE FOR FOCUSSING THE DISSECTING MICROSCOPE WITH THE FOOT

EVERY one who has done much work with a dissecting microscope has doubtless felt the need of a third hand for use in focussing as the object under dissection sinks down or springs up. A good hold on an elusive object often must be relinquished to enable one to focus on the object, which may be pushed out of focus again when work is begun on it.

For some years I have been urging on various

makers of microscopic apparatus the need of a foot-focussing device, with the result that one manufacturer has promised to design such an accessory at an early date. In the meantime I have developed a device which is very useful and fulfils most of the requirements which I had laid down for such a contrivance. A small screw-clamp, such as is used for rubber tubing, was fastened on the lower part of the rim of the focussing wheel of a wide-field binocular microscope. To this clamp a strong, smooth cord was attached which was passed upward and back over the wheel in a groove which the maker had provided, conveniently, though for what purpose I have no idea. The cord was lowered from the wheel to the floor, where it was attached by a screw-eye to the end of a light piece of wood about 2½ inches wide and one foot long. The length of the cord was adjusted so that one end of the wood pedal was lifted about 2½ inches from the floor, while the other end rested on the floor and served as a pivot. When the pedal was pushed downward the cord pulled on the wheel so as to turn it and raise the objectives. Downward movement was secured by passing a rubber band of proper strength under the stage of the microscope and fastening it above the stage to an adjusting screw on the inside of the arm. The microscope used has such a screw, so placed that it holds the rubber band well back from the stage where it does not interfere with the examination of large objects, or the use of dissecting trays. With a little alteration the same scheme could be used on other microscopes which do not have a screw on the inside of the arm. Most of the common types of binoculars have the groove in the focussing wheel which serves as a pulley for the cord.

This arrangement provides a sufficient range of focus for ordinary work, and where the objective needs to be raised higher the clamp can be set further around on the wheel. If the rubber band is not too strong the tension needed to hold the microscope in focus is slight, and the effort made is scarcely greater than that of pressing down the accelerator on an automobile. The heel is rested on the floor and the ball of the foot placed crosswise of the pedal at the point found most convenient.

For safety the microscope may be fastened to the table by a small clamp, but this is not essential if the apparatus is properly adjusted and the microscope well oiled. The cord rarely jumps from the wheel and when it does can be replaced in an instant. Unless the microscope is set so as to project a little over the table the cord will rub against the edge of the table, but this does not interfere with the working of the device.

Either foot may be used, and the cord may be attached on either the right or the left side of the microscope, as desired. The apparatus has several advantages. It may be made in a few minutes from supplies available everywhere, and may be attached to or detached from the microscope in a minute. It may be used on any table without marring it in any way. Adjustment to tables of different heights merely involves a change in the length of the cord.

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AN IMPROVED SODIUM BURNER[1]

EXPERIENCE here over a period of several years has revealed the need for an improved sodium burner for use in polarimetry. Burners which have been previously described, or used here, are open to the objections that the light is either too small in size, or that its intensity is inadequate or of insufficient duration. A fairly satisfactory type of burner is that of Caldwell and Whymper,[2] who passed gas through a mixture of salt and sand into a blowpipe for combustion with air. This burner was improved by West,[3] who devised a glass burner with a salt reservoir for introduction of the salt by tapping. Making use of the most obvious advantages of the burners of Caldwell and Whymper, and of West (introduction of powdered salt into the gas flame) we have devised the improved sodium burner shown in Fig. 1. By the action of an electrically driven vibrating unit against the bottom of a funnel salt is introduced into the flame of this burner. The burner is capable of producing a very intense light at the will of the operator. This action at a distance of several feet from the observer permits readings with an intensified light without fatigue of vision caused by direct tapping.

The salt funnel (C) is of brass and 50 mm. square at the top, which contains a filling cap. The bottom of the funnel is grooved and sloped to the opening into the mixing chamber (B), which contains inlets of metal tubing for gas and air. The opening into the mixing chamber may be cleaned through the hole shown capped. The mixing chamber, also of brass, is 35 mm square and 40 mm in height, with a curved bottom and an opening of 20 mm at the top into the brass chimney (A), shaped as shown. This chimney (A) is 160 mm in height, of the Meker type, with a

[1] Contribution from the Department of Physiological Chemistry, Loyola University School of Medicine, Chicago, Ill. Demonstrated by the authors at the twenty-sixth annual meeting of the Federation of American Societies for Experimental Biology, in Philadelphia, April 28, 1932. The burner described in this paper was constructed with the kind cooperation of Messrs. E. H. Sargent and Co., Chicago.

[2] R. J. Caldwell and R. Whymper, Proc. Roy. Soc., (A) lxxxi, 112.

[3] E. S. West, *Jour. Lab. and Clin. Med.*, 14: 267, 1928.

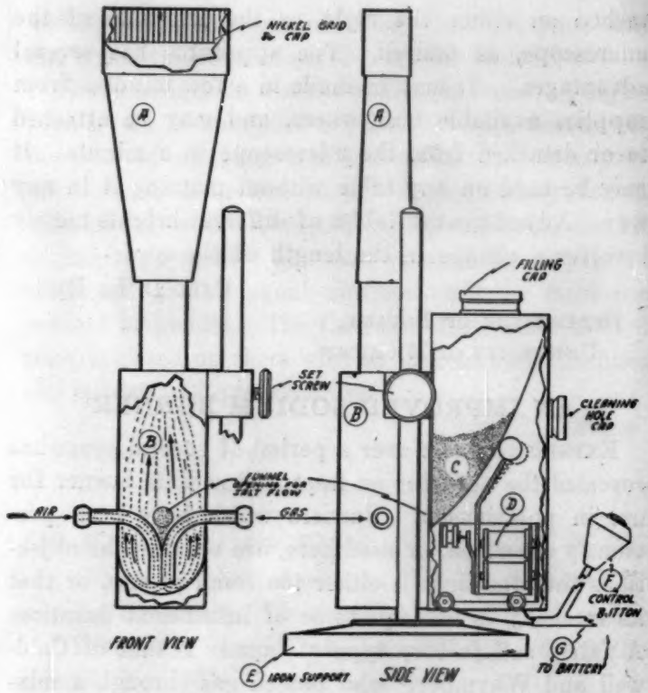

FIG. 1. An improved sodium burner, showing: I—Side view of the complete burner with one side wall cut away to expose the vibrating mechanism (D) and funnel (C) containing salt; II—Front view of chimney (A), of Meker type, and attached mixing chamber (B), into which gas, air and powdered sodium chloride flow before combustion. (Drawn to scale and reduced to about one fourth of actual dimensions.)

nickel grid inside a cap, 30 x 55 mm at the rectangular top. Fixed under the salt funnel is the vibrating unit (D), connected by five feet of insulated wire to the press button (F), and to a battery (G) of one or two dry cells. The entire burner is clamped on a short iron stand which permits adjustment for height.

In order to operate the burner the funnel is first filled with salt and capped. Air is then blown through the mixing chamber to displace any salt which may have fallen in during the filling of the funnel. The air is turned off and the gas is ignited to give a final flame of the desired size. Air is then introduced to give the most efficient combustion of the gas. The burner is placed with the front toward the polariscope. A short period of action of the vibrating unit causes the salt to flow into the mixing chamber from whence it is carried up by the forced draft of air and gas and burned in the flame.

As a sodium salt we have found the chloride, finely powdered for 24 hours in a ball mill and dried at 110 degrees C., most satisfactory, although the anhydrous powdered sulphate has also given an intense light. The burner may be used to produce monochromatic lights from non-hygroscopic salts of other metals. The size of the flame may be reduced for spectroscopic studies. If operated for long periods of time, particularly without critical adjustments of gas and air, the burner should be placed in a well-ventilated hood for removal of fumes.

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W. C. AUSTIN

SPECIAL ARTICLES

THE PRESENCE OF BACTERIA WITHIN THE EGGS OF MOSQUITOES

IN connection with certain experiments on the food of mosquito larvae (to be described elsewhere) the investigator was astonished to find evidence of viable organisms within the ova of *Aedes aegypti*. Six eggs, after a thorough disinfection in hexyl resorcinol,[1] were introduced into sterile 0.5 per cent. dextrose bouillon and the cultures incubated at 80° F. In one instance a larva hatched after 48 hours and the media remained sterile for 9 days, at the end of which time a second larva hatched and within 24 hours a spontaneous contamination appeared in the culture. Throughout the course of the experiment the plug was not removed from the flask. This sudden appearance of bacterial growth could not be explained on the basis of a slow growing organism, otherwise a heavy growth would not have suddenly arisen in a flask which had previously remained perfectly clear for a period of nine days. This first observation was made in January, 1931, and since then in several hundred experiments, with different types of media, only seven additional clear-cut instances have been found. The length of time these eight cultures remained sterile, previous to the appearance of contamination, varied from 5 to 11 days, the average being 9 days. The organisms isolated include the following—gram negative and gram positive bacilli, staphylococci and yeast.

It is only in cases where the hatching of certain of the eggs is delayed for several days that this phenomenon could be demonstrated. If the contamination had arisen within the first 72 hours or had appeared slowly it might be assumed that the exterior of the eggs had not been sufficiently sterilized or their introduction into the media not carefully executed. It is felt that in many such cases where contamination did appear promptly this may be accounted for by the presence of bacteria in the eggs. To the writer only one explanation of the above quoted experiments seems tenable—namely, that bacteria were present in the eggs which were delayed in hatching and upon emergence of the larva the bacteria multiplied rapidly in the bouillon. In media other than that suitable for rapid growth of bacteria there could be no indica-

[1] E. H. Hinman, *Amer. J. Trop. Med.*, 12: 263, 1932.

tion as to when the contamination arose, but in bouillon it becomes apparent immediately.

HISTOLOGICAL STUDY OF CULICID EGGS

In order to test the above-mentioned hypothesis a considerable number of eggs of the following species of mosquitoes have been sectioned—*Aedes aegypti*, *Anopheles quadrimaculatus*, *A. crucians* and *Culex quinquefasciatus*. The eggs were fixed in Bouin's fluid, very gradually passed up through the alcohols during the course of a week, cleared in cedarwood oil, passed through xylol and infiltrated and imbedded in paraffin. The eggs were allowed to orientate themselves at random in the paraffin, but of course were all in the same horizontal plane so that longitudinal sections could readily be obtained. Several hundred eggs were imbedded in a block and in the case of *Culex quinquefasciatus* a number of egg masses (200 to 500 ova per raft) were placed in each block. Altogether several thousand eggs have been sectioned, cut 5 μ or less in thickness. Different stains have been tested, including iron hematoxylin, methylene blue, acid-fast and gram stain. In a few slides a very delicate hematoxylin stain was first applied, followed by a bacterial stain. The gram stain alone has proven most satisfactory.

Microscopical examination of these sections has revealed the presence of bacteria in a number of slides. Probably only a relatively small percentage of eggs actually contain organisms, as would be indicated by both cultural experiments and histological study. The most common type of bacteria encountered in the sections was the coccus, but on occasion streptococci have been found and also other cocci showing evidence of division. Bacilli were very rare and in no case were large numbers found in any egg.[2] The difficulties involved in the demonstration of bacteria in tissues are well known and in a number of instances organism-like structures were observed, but because of indefiniteness of staining, irregularity of outline or size there was considerable hesitation in regarding these as true bacteria.

From a careful examination of over 250 slides the writer feels assured that bacteria occasionally occur in mosquito ova. Unless *large* numbers of eggs had been used, the results might well have been negative.

The possibility of hereditary transmission of the etiological agent of either yellow fever or dengue through the mosquito host is of great epidemiological importance. To date experimental work along these lines has been negative, with a single doubtful exception. Yet if viable bacteria may occasionlly be recovered from the ova of *Aedes aegypti* one might expect that the virus of either yellow fever or dengue would, under certain circumstances, appear in the eggs of infected females.

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[2] The writer is greatly indebted to Colonel C. F. Craig for his examination of certain of these sections and appreciates his valuable opinion in this matter.

THE IDENTITY OF STREPTOCOCCI OF ANIMAL ORIGIN WITH CERTAIN STRAINS OF STR. EPIDEMICUS[1]

STR. EPIDEMICUS was originally described by Davis[2] as the etiological factor in milk-borne epidemics of septic sore throat. This organism differed from ordinary hemolytic streptococci in that it produced distinct capsules, produced large, moist colonies on blood agar and was less actively hemolytic than the usual strains of *Str. hemolyticus*. Brown, Frost and Shaw[3] in a study of the beta streptococci in milk found certain strains of streptococci which produced a low acidity in glucose broth, failed to hydrolize sodium hippurate, caused complete hemolysis in a fluid medium, produced capsules, and gave large, moist colonies on blood agar. These strains produced acid from lactose, sucrose and salicin while they did not attack mannite. Such cultures were referred to as *Str. epidemicus* and classified as streptococci of human origin.

In a previous paper[4] we have shown that there exists among the lower animals a great group of hemolytic streptococci possessing the characters attributed by Brown, Frost and Shaw[3] to human streptococci. It is apparent that streptococci possessing the characters of the human type of Brown, Frost and Shaw can no longer be considered to be of strictly human origin. Furthermore, it was demonstrated that 96 per cent. of the streptococci of animal origin could be differentiated from human streptococci by their action on sorbitol and trehalose. Of 40 human cultures tested, all fermented trehalose and failed to attack sorbitol. Of 125 animal strains examined, 120 produced acid from sorbitol but failed to ferment trehalose. The remaining five animal strains have not as yet been successfully differentiated from the human streptococci.

Since the publication of our first paper[4] it has been found that the group of 120 animal strains referred

[1] The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the director.

[2] D. J. Davis, "Bacteriologic Study of Streptococci in Milk in Relation to Septic Sore Throat," *Jour. Amer. Med. Assoc.*, 58, 1852. 1912.

[3] J. H. Brown, W. D. Frost and M. Shaw, "Hemolytic Streptococci of the Beta Type on Certified Milk," *Jour. Infect. Dis.*, 38, 381, 1926.

[4] P. R. Edwards, "The Biochemical Characters of Human and Animal Strains of Hemolytic Streptococci," *Jour. Bact.* In press. 1932.

to above regularly produce capsules under suitable conditions. Furthermore, on the blood-ascitic fluid agar of Pilot, Hallman and Davis[5] these cultures produce large, moist, surface colonies and spreading colonies between the agar and glass.

The group of 120 cultures has been compared with 16 cultures of *Str. epidemicus*.[6] The two groups have been found identical in every respect. They produce a low acidity (not exceeding pH 4.8) in glucose broth, fail to hydrolyze sodium hippurate, produced a marked hemolysis in fluid mediums, and under suitable conditions produce large, distinct capsules. On ascitic fluid-blood agar they produce large, moist colonies. They ferment lactose, sucrose, salicin and sorbitol. Mannitol and trehalose are not attacked.

From the results cited above it is evident that, by the methods now in use, it is not possible to differentiate the cultures of *Str. epidemicus* in question from streptococci of animal origin. The group of animal strains which we have studied is composed of cultures isolated from horses, chickens, hogs, cows and foxes. This type is the predominant one in animals and, with the exception of the high-acid-producing strains from bovines and *Str. equi* of strangles, comprises approximately 95 per cent. of the hemolytic streptococci of animal origin which we have studied.

Further comparative studies are being carried out with cultures identified as *Str. epidemicus* in other laboratories. The results of these studies will be reported later.

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KENTUCKY AGRICULTURAL EXPERIMENT STATION

THE CAROTENE CONTENT OF TEN VARIETIES OF CARROTS

LITTLE is known of the variation in carotene content of different varieties of carrot, other than the fact that the roots of certain varieties look yellower than others. For this study ten varieties, comprising white, yellow and orange garden and field carrots, were grown under greenhouse conditions. Seeds were planted in November, and the plants were harvested 23 weeks later.

For analysis, the roots were chopped, and a 50 gram sample was ground with sand. Without being dried, the sample was exhaustively extracted with cold acetone, and the extract was shaken with 1 volume of petroleum ether and 2 volumes of 2 per cent. NaCl. The pigment passed completely into the petroleum ether layer. The aqueous acetone layer was discarded and the petroleum ether was washed 4 times with the salt solution.

The petroleum ether extract was compared spectrographically with a weighed amount of purified carotene, which had been put through the same "extraction" procedure as the carrot roots themselves. Comparison of the characteristic blue-violet absorption bands photographed in the series of known and unknown dilutions gave the data from which the carotene content was estimated.

TABLE I

Variety of carrot	Carotene content	
	mg per 100 gm	gm per bushel
Early Scarlet Horn	9.6	2.2
Oxheart (Guerande)	8.9	2.0
Long Orange	8.3	1.9
Danvers Half Long	8.2	1.9
Chantenay	8.0	1.8
Earliest Scarlet Forcing	6.4	1.5
Large Yellow Belgian	2.9	0.66
Isbell's Victoria	1.5	0.34
Large White Belgian	0.15	0.034
Isbell's Maude S	0.12	0.027

The findings are summarized in Table I, from which it is evident that the garden varieties contain the largest amount of carotene, although traces are found even in the white field carrots. The extremes in carotene content are shown by Early Scarlet Horn and Isbell's Maude S, the former having 80 times as much as the latter. It is an interesting exception to the common preference for colorless foods that the varieties of carrot most highly esteemed for human consumption are those containing the most carotene.

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[5] I. Pilot, B. Hallman and D. J. Davis, "A Culture Medium for the Isolation of *Str. epidemicus*," *Jour. Amer. Med. Assoc.*, 95, 264, 1930.

[6] These cultures were kindly furnished us by Dr. W. D. Frost. The group is composed of cultures isolated from the udders of cows and from epidemics of septic sore throat in humans.

BOOKS RECEIVED

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